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REPORT ON ASDAR MONITORING RESULTS

OCTOBER - DECEMBER 1993

S. G. Smith

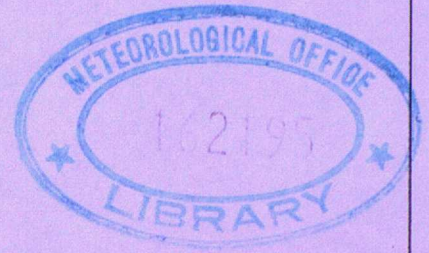
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THE ASDAR CENTRE

REPORT ON ASDAR MONITORING : OCTOBER - DECEMBER 1993

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1). INTRODUCTION

ASDAR reports received into the Met. Office Synoptic Data Bank (SDB) have been monitored by the ASDAR Centre since the first ASDAR unit began flying on 29/11/90. The aim of the monitoring is to detect and identify any problems with the data or their transmission as soon as possible and to instigate fault correction procedures. These processes are vital to maintaining data quality and credibility.

Monitoring of the observations has covered data availability, receipt delays, reporting frequency and checks on the consistency and quality of the meteorological data. All irregularities have been reported to the ASDAR Technical Centre.

This report highlights outstanding problems with data availability, transmission and quality, and with fault correction procedures.

2). OPERATIONAL UNITS

Seven ASDAR units reported during the period, though one, CO00768Z, did not report after 14th November because the aircraft was de-commissioned from service. The fault affecting unit LH005VNZ, reported in the previous report, had still not been resolved by 31st December and no reports were received from it in the latest quarter.

The following table shows the carriers, types of aircraft, identifiers and the dates on which observations were first and last received :-

AIRLINE	AIRCRAFT TYPE	IDENTIFIER	OPERATIONAL START	DATES END
British Airways	747	BA000NEZ [@]	12/ 6/92	
British Airways	DC 10	BA001LLZ	29/11/90	
British Airways	DC 10	BA008DJZ	19/12/91	
British Airways	DC 10	BA009BMZ	11/ 2/92	
British Airways	747	BA010PUZ	27/ 6/91	
Continental Airlines	747	CO00624Z ^{\$}	17/10/91 ⁺	2/ 4/93
Continental Airlines	DC 10	CO00768Z	20/10/91	14/11/93
KLM	747	KL012UMZ ⁼	23/ 4/92	
Lufthansa	747	LH005VNZ	23/ 6/93	

@ Unit identifier reported as BA000NDZ before 4/10/92.

\$ Unit identifier changed from CO006PEZ on 19/11/91.

+ Some observations were received from this unit on 3/6/91 but it was not considered to be operational at that time.

= Unit identifier reported as PH012UMZ before 11/5/93

3). LIST OF OUTSTANDING PROBLEMS

A list is given below of known faults and anomalies present during the latest three month period :-

i) that were also present in the previous period (long term) and

ii) that became apparent in the latest 3-month period (new)

All have been reported to the ASDAR Technical Centre, who inform the relevant bodies where appropriate. For faults where a specific unit is not mentioned, the fault is present for more than one unit (usually several).

i) Long term problems

a) Occasional missing positional information eg latitude.

b) Occasional erroneous data eg impossibly strong wind speeds.

c) Missing reports (occasionally whole flights missing).

d) Spurious observations - reports received while aircraft are on the ground but flight level indicates aircraft is airborne ; usually such reports are from KL012UMZ.

e) Temperature biases - there are positive temperature differences for KL012UMZ relative to numerical forecast model fields of about 1.9 deg C at cruise levels. There are also positive temperature differences of about 1.3 deg C for BA009BMZ at all levels. Temperature differences taken over all the other units are about +0.4 deg C for all levels, which might be due to a model bias. Fig 1 shows a time series plot of monthly mean differences at the cruise levels for KL012UMZ (=2UMZ), BA009BMZ (=9BMZ) and all other units combined.

The negative temperature bias described in the last report for KL012UMZ in the ascent/descent phases is significantly less pronounced in the latest three months (see fig 2).

f) Varying cruise flight levels - cruise flight levels reported from KL012UMZ fluctuate more frequently than those from other ASDAR aircraft and regularly vary by 100 or 200 feet between observations. Although this feature is anomalous, it does not affect the validity of the ASDAR meteorological data.

ii) New problems

a) Duplicate data - some reports from BA001LLZ on 3rd November appear to have been repeated on 4th November. The reason for this is not known.

b) Data assigned to the wrong date - on a few occasions in the last 3 months ASDAR data have been assigned to the wrong date (either one day early or late) in the Met Office data bank. This is due to limitations of the ASDAR code (and indeed of aircraft reports generally) with regard to the specification of date of report. It is not a 'new' problem as such but one that has only caused this incorrect assignation of date for ASDAR data recently. Occasions when reports are assigned to the wrong date are associated with bulletins containing reports spanning a long period and/or when data are received late.

4). MONITORING RESULTS

i). Data Availability

ASDAR reports are received via Darmstadt (EESA), Washington (KWBC) and Tokyo (RJTD), depending on the location of the aircraft. Table 1 shows for each unit the number of reports received in the SDB, the number of days when no reports were received, the average number of reports received per day and an estimate of the number of complete ascents, complete descents, level flight stage and complete flights that were not received.

As reports received are not checked to flight schedules it is likely that the absence of some complete flights will be missed. The number of reports received is adjusted to remove duplicates (identical versions of the same report) but, due to inconsistencies in the reports received via Washington and Darmstadt, the totals are likely to include some duplicates.

All days had at least 3 units reporting. Periods of more than 7 days when a particular unit did not report were :-

BA000NEZ : Oct 7th - Oct 23rd
BA001LLZ : Nov 20th - Nov 26th
BA008DJZ : Dec 24th - end of period (routine aircraft maintenance)

Unit KL012UMZ provided the most data. Over the 3 month period as a whole an average of 881 reports per day were received from all units combined, compared with 960 in the previous three-month period.

ii). Data Coverage

Of the 7 aircraft carrying ASDAR units during the period, all those except that flying CO00768Z flew predominately between Europe and North America or within these regions. The aircraft carrying CO00768Z flew between North America and Australasia (via the Pacific).

iii). Data Timeliness

Table 2 gives the frequencies of report receipt delays. Receipt delay is taken to be "time of receipt in SDB - time of report" and reports where the time is missing are ignored.

Speed of data receipt was good with 76% of reports being received within one hour of observation time and 98 % within two hours, over all reporting units.

iv). Frequency of Reporting

The expected frequency of ASDAR reports is one every 7 minutes during level flight and one every 10 hPa or 50 hPa during ascent and descent (with the higher frequency applying to the lower part of the atmosphere). Taking daily samples wherever possible, the average time between reports during level flight, and the average pressure difference (in hPa) between the first 10 reports on ascent and the first 10 reports below 3500 feet (approximately 890 hPa) on descent are shown in Table 3. Maximum and minimum values are also given. The pressure differences are obtained from height differences using the standard atmosphere relationship that 1 hPa is approximately equivalent to 29 feet in the layer 1000-900 hPa.

From Table 3 it can be seen that all the reporting units achieved the "report every 7 minutes" target in level flight. All units also achieved the "report every 10 hPa" target in the near-ground phase of ascent. The mean frequency for near-ground descent was slightly poorer than the specified criterion for all units except BA001LLZ. BA000NEZ and BA010PUZ are notable for their high frequencies of reporting in level flight, both with means of about once every 4.5 minutes.

5). DATA QUALITY

Figures 3 to 10 show for each individual unit and the complete three month period the results of "O-B" (observation minus background i.e. a 6-hour forecast) and "O-A" (observation minus analysis) comparisons for all levels between 950 and 150 hPa. The UK 19-level global forecast model is the model used for the comparison. Results are given for temperature and for wind (u component, v component, speed, direction and rms vector) separately and show mean and standard deviation of the differences from the model fields at each level. Hand-written headings have been added to fig 3 to clarify the charts.

Although both "O-B" and "O-A" plots are shown, comparison with the background field is more meaningful as in data sparse areas the model analysis will tend to fit to an observation, regardless of its quality, provided it passes the quality control.

The temperature anomalies mentioned in section 3 for BA009BMZ and KL012UMZ are apparent. The standard deviations of the wind speeds and directions are higher for all units compared to the previous 3 month period and for the same period in 1992. This is believed to be due to a problem with the archiving of model information which is being investigated. Note that a known problem with the archiving of 18z analysis data during the period has meant that 18z analysis data have been excluded from the profile statistics shown in figs 3-8.

6). SUMMARY

i) Overall timeliness and quality of the data from the existing operational units remain high.

ii) Seven units reported during the period. However after 14th November a maximum of 6 units reported on any one day because the aircraft flying CO00768Z was de-commissioned. The fault with unit LH005VNZ, which caused it to be withdrawn from service in August, was still not resolved by the end of December.

iii) Temperatures from BA009BMZ and KL012UMZ compared to model background temperatures continued to be somewhat anomalous at cruise levels.

iv) All units maintained the stipulated reporting frequencies for level flight and for near-ground phase of ascent. The frequency for near-ground phase of descent fell slightly short of stipulated frequencies for all but one unit.

v) Spurious reports from the ground continue to be received, particularly from KL012UMZ.

TABLE 1 : SUMMARY OF DATA RECEIVED AND MISSING DATA : OCTOBER - DECEMBER 1993

UNIT	NO. REPORTS RECEIVED	PERCENTAGE VIA KWBC EESA RJTD	"NO REPORT" DAYS	AVE NO. PER DAY*	< - ASC	OF MISSING DES	EVENTS-> LF	CF
BA000NEZ	13043	19 81 -	23	189	25	20	0	1
BA001LLZ	10972	22 78 -	19	150	29	18	0	4
BA008DJZ	11559	41 59 -	17	154	30	27	1	1
BA009BMZ	13597	42 58 -	5	156	36	41	2	0
BA010PUZ	9288	46 54 -	39	175	14	17	0	1
CO00768Z	6737	69 2 29	52	168	14	10	1	0
KL012UMZ	15812	43 57 -	2	176	64	49	2	1
TOTAL	81008							

NOTES

* Days with no reports are excluded for averaging purposes.

KEY TO "MISSING DATA" TABLE HEADINGS

ASC : Complete ascent
DES : Complete descent
LF : Level flight
CF : Complete flight

TABLE 2 : SUMMARY OF DELAY FREQUENCIES : OCTOBER - DECEMBER 1993

UNIT	NUMBER OF REPORTS	PERCENTAGE FREQUENCIES OF DELAY----->										MAXIMUM DELAY	MEAN DELAY
		0-30	31-60	61-120	121-180	181-360	361-720	>720	MINUTES----->				
BA000NEZ	13043	34.0	44.3	20.7	0.4	0.4	0.2	-				492	45
BA001LLZ	10972	33.6	44.0	20.6	0.7	0.8	0.2	-				467	46
BA008DJZ	11559	25.3	49.5	23.8	0.4	0.8	0.1	-				530	47
BA009BMZ	13597	26.3	49.0	22.8	0.9	1.0	0.1	-				459	48
BA010PUZ	9288	27.8	47.8	22.6	1.1	0.6	0.1	-				396	47
CO00768Z	6737	17.1	47.5	34.3	0.6	0.5	0.0*	-				510	53
KL012UMZ	15812	30.9	48.1	19.0	1.3	0.7	0.0*	-				371	45

TOTALS	81008	28.7	47.2	22.5	0.8	0.7	0.1	-				530	47

NOTE

* Percentage between 0 and 0.05.

TABLE 3 : SUMMARY OF REPORTING FREQUENCIES : OCTOBER - DECEMBER 1993

UNIT	<-----LEVEL FLIGHT----->				<--ASCENT (1st 10 OBS)-->				<DESCENT(10 OBS AFTER 890hPa)>			
	N. O. S.	MEAN <-----MINUTES----	MIN	MAX	N. O. S.	MEAN <-----hPa----->	MIN	MAX	N. O. S.	MEAN <-----hPa----->	MIN	MAX
BA000NEZ	64	4.5	2.9	6.1	44	10.0	9.6	10.7	40	10.2	8.8	13.0
BA001LLZ	65	6.3	4.2	7.0	35	10.0	9.6	10.0	34	10.0	7.7	11.9
BA008DJZ	40	6.3	4.9	7.0	35	9.9	9.6	10.0	41	10.5	9.2	11.9
BA009BMZ	75	6.3	4.7	7.0	40	9.9	9.6	10.0	49	10.3	8.8	11.9
BA010PUZ	44	4.8	3.6	6.1	33	9.9	8.8	11.1	31	10.6	9.6	13.0
CO00768Z	15	6.5	4.7	7.0	33	9.9	9.6	10.0	32	10.6	8.8	11.9
KL012UMZ	1 *	-	-	-	62	9.9	9.6	11.9	38	10.4	8.4	13.0

KEY TO "REPORTING FREQUENCY" TABLE HEADINGS

N. O. S. : Number of samples.

NOTE

* KL012UMZ - cruise flight levels fluctuate frequently (see text)

Monthly mean ASDAR O-B temperatures (deg C)

150-350 hPa

Key : 9--9 9BMZ 2 2 2UMZ 0 0 OTHERS

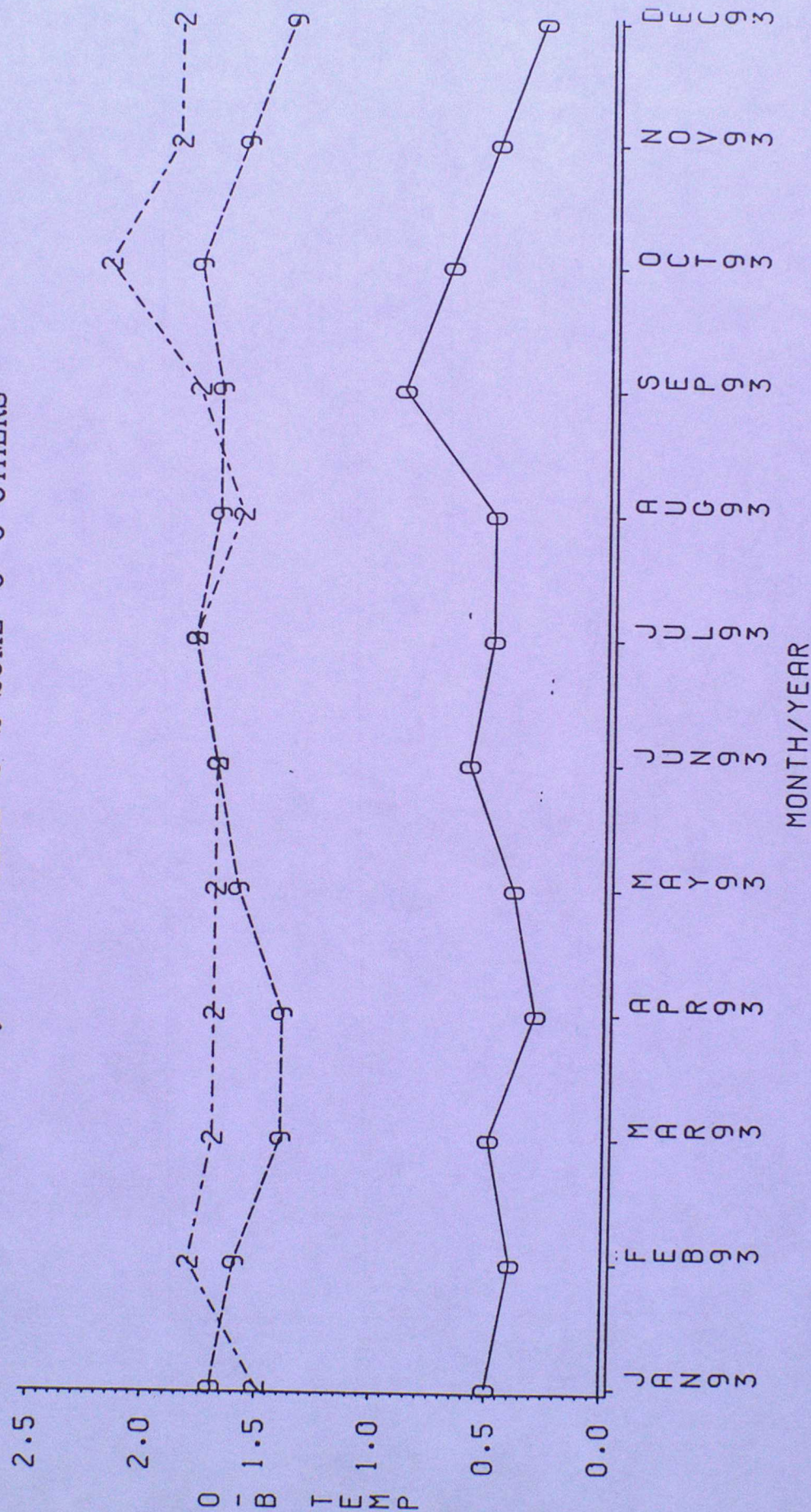


Figure 2

Monthly mean ASDAR O-B temperatures (deg C)

400-950 hPa

Key : 9--9 9BMZ 2 2 2UMZ 0 0 OTHERS

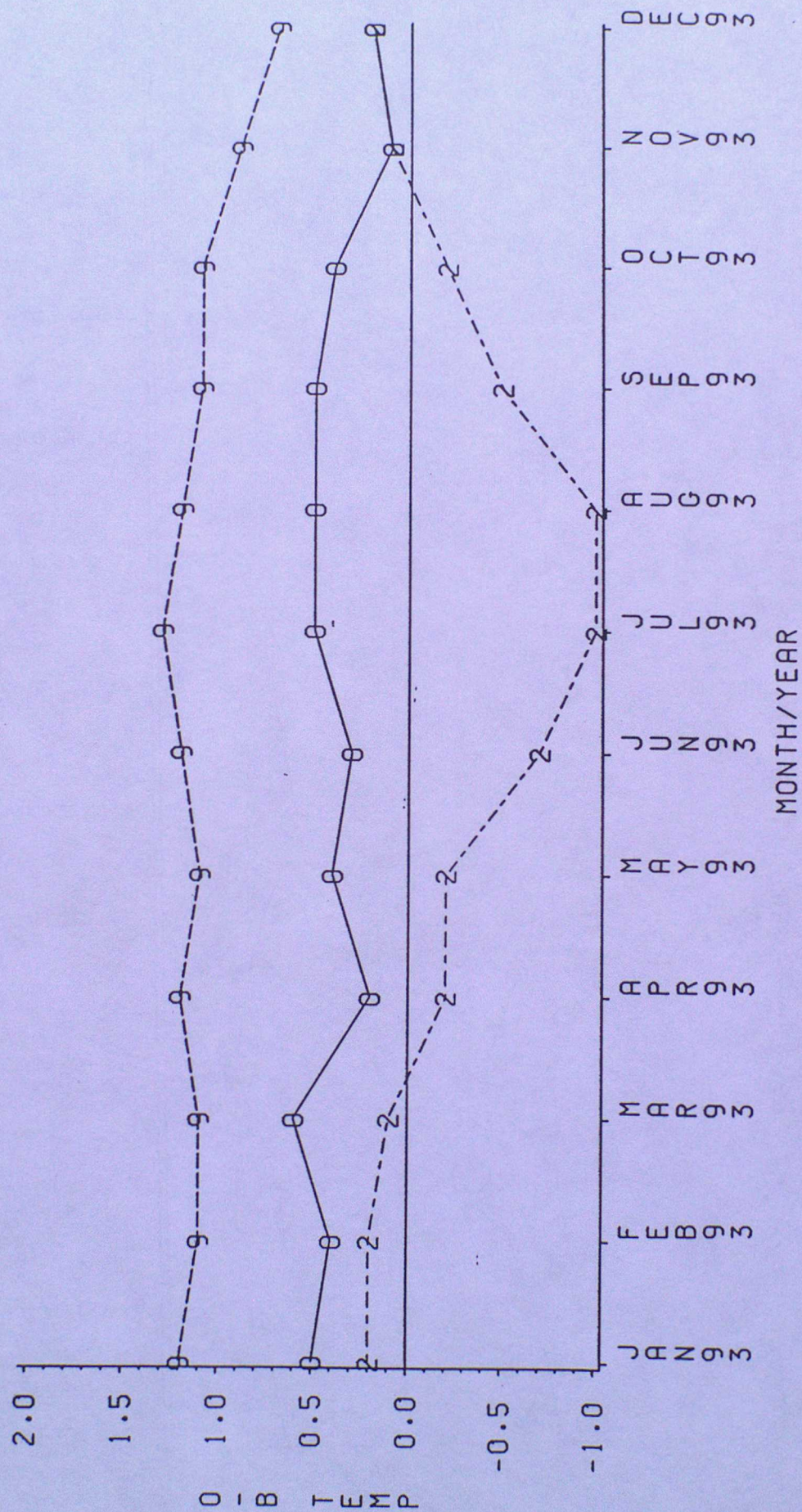


FIGURE 3 : BA000NEZ - MODEL COMPARISON RESULTS (950-150 hPa)

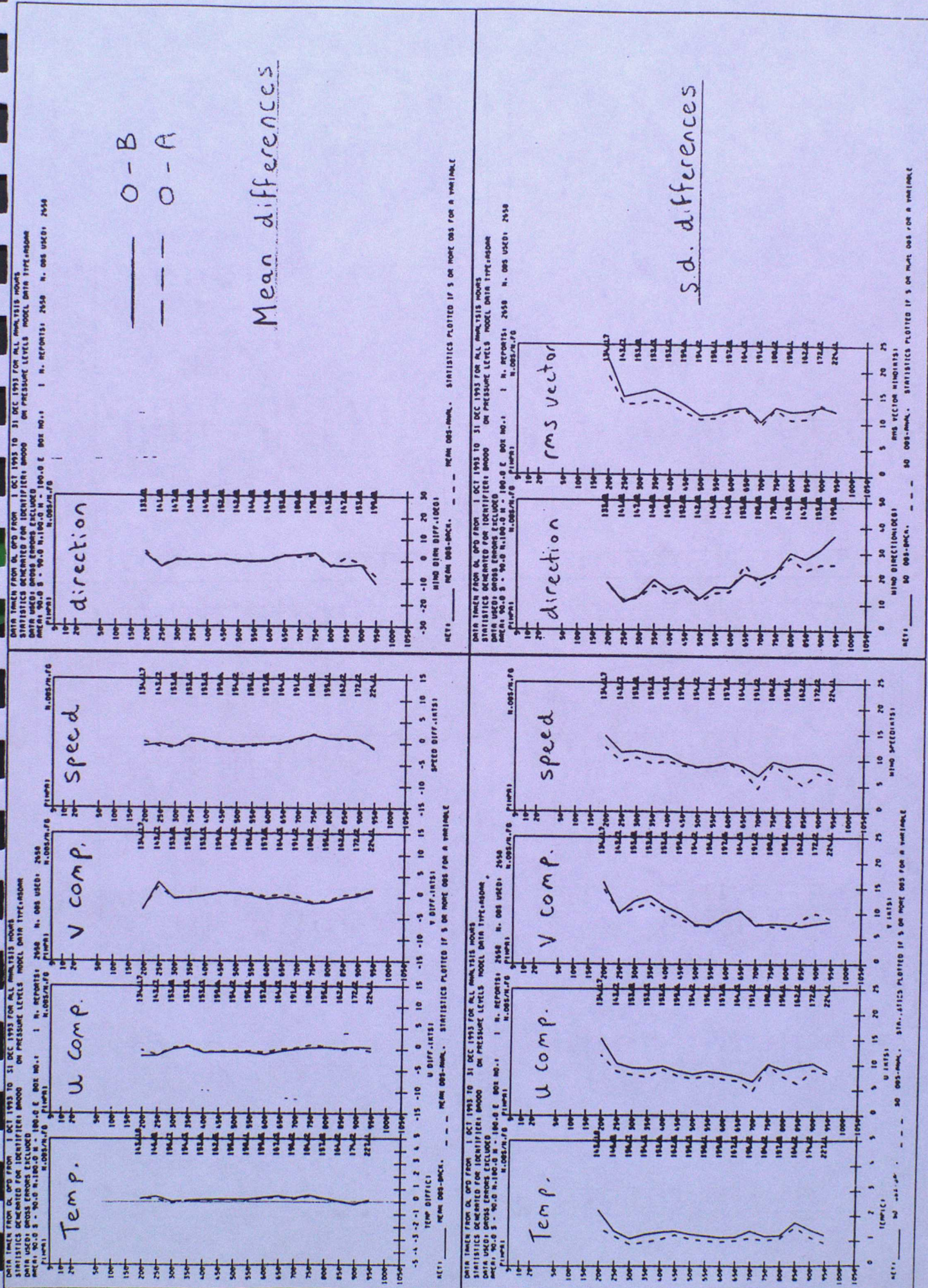


FIGURE 4 : BA001LLZ - MODEL COMPARISON RESULTS (950-150 hPa)

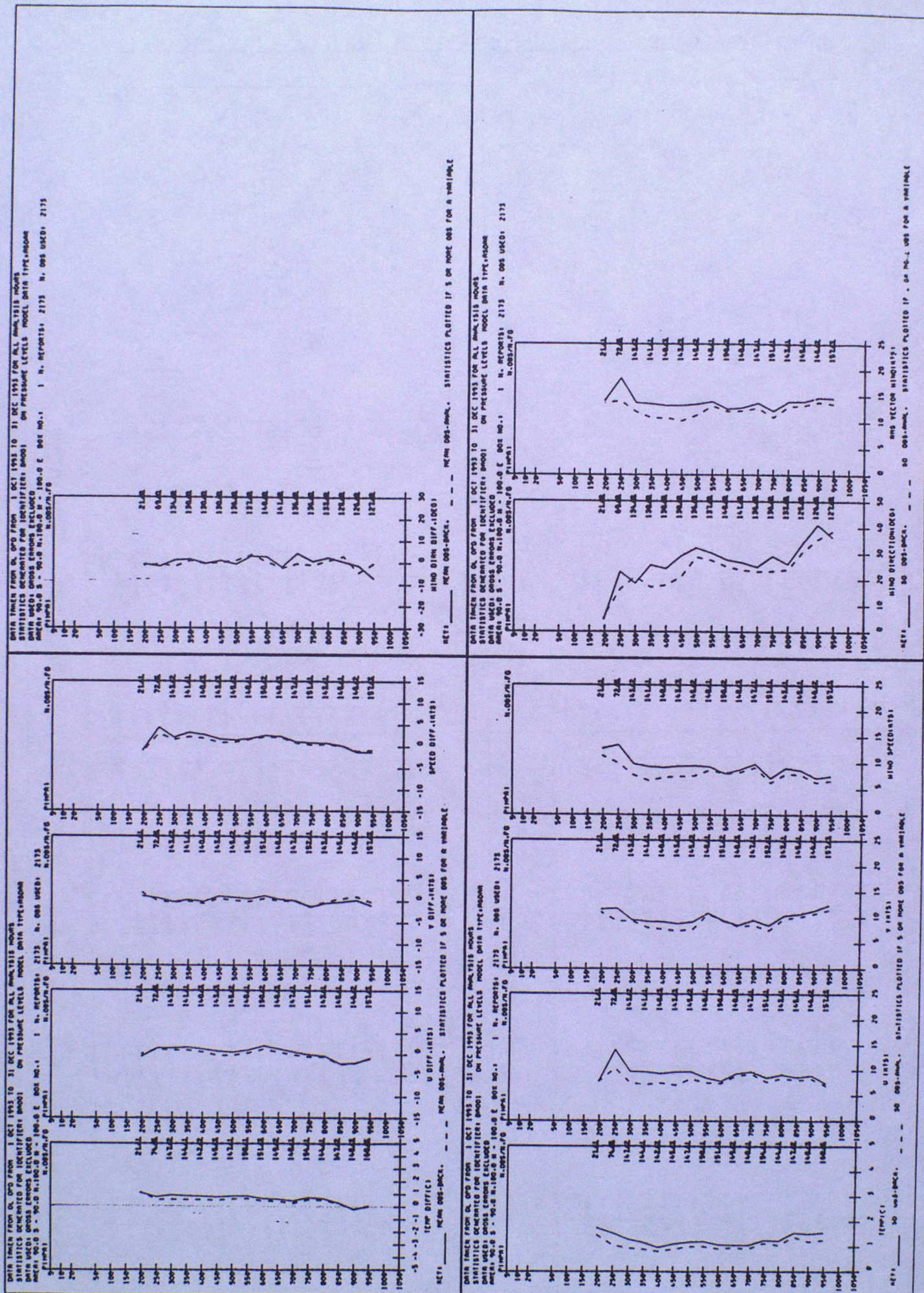


FIGURE 5 : BA008DJZ - MODEL COMPARISON RESULTS (950-150 hPa)

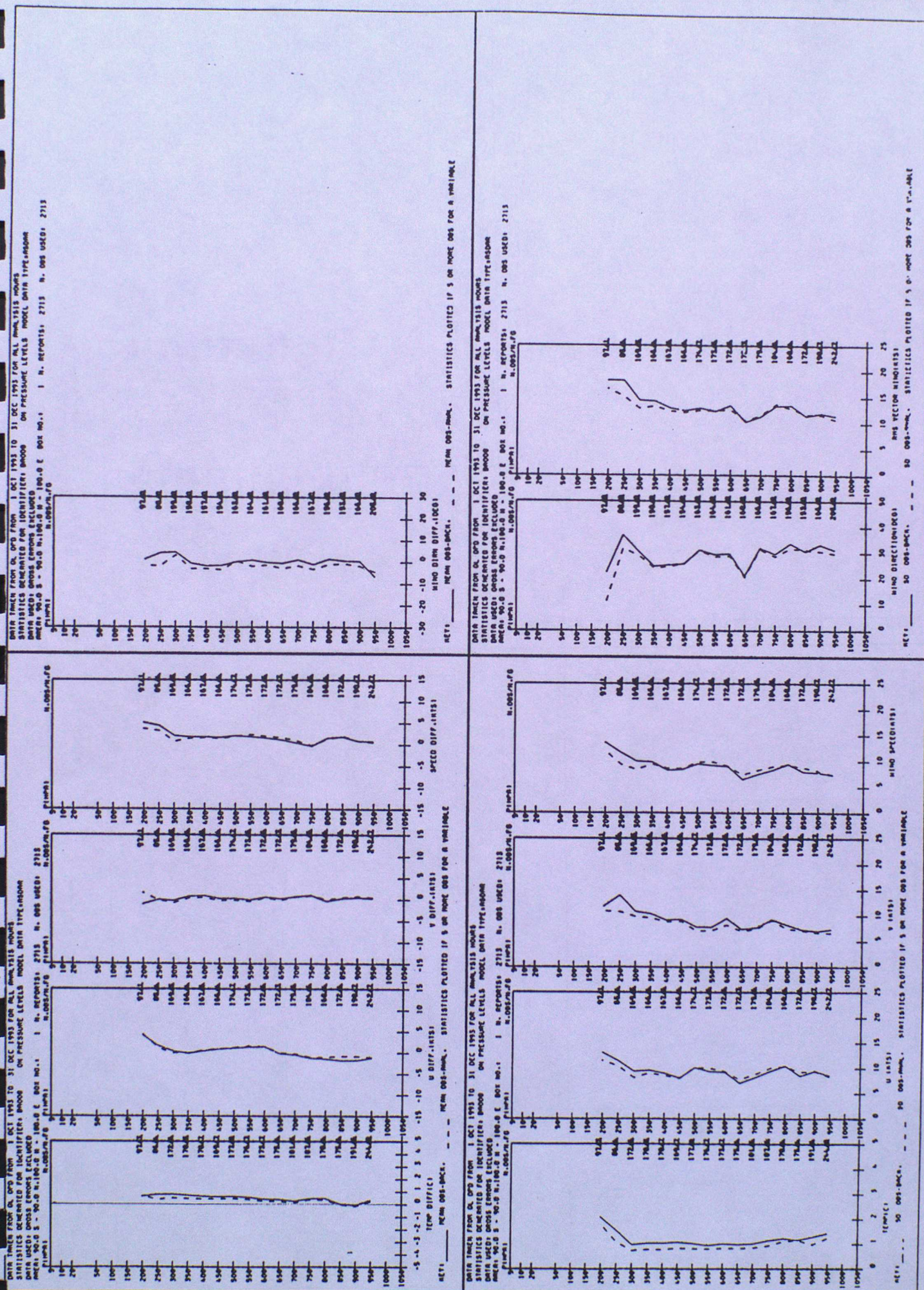


FIGURE 6 : BA009BMZ - MODEL COMPARISON RESULTS (950-150 hPa)

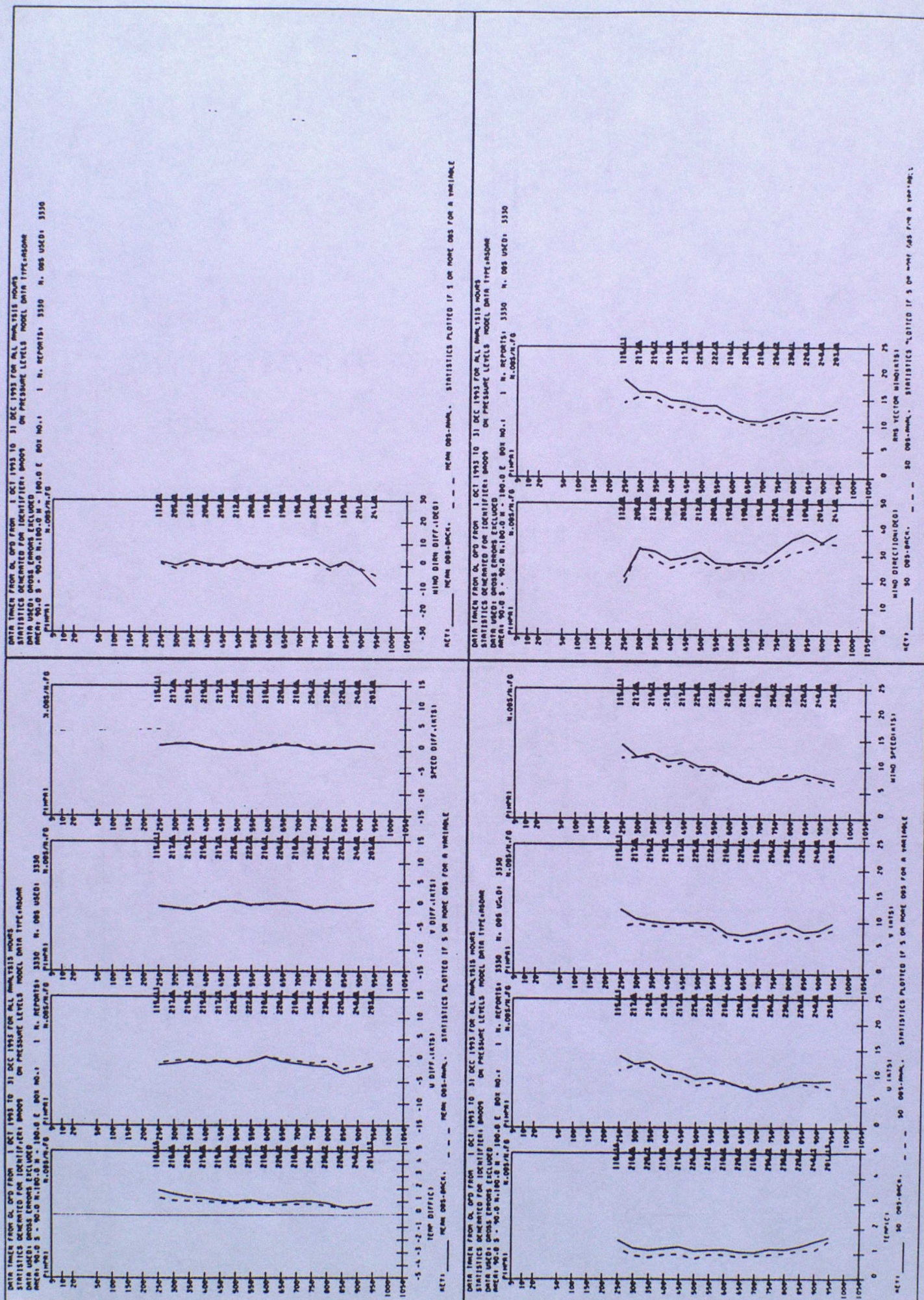


FIGURE 7 : BA010PUZ - MODEL COMPARISON RESULTS (950-150 hPa)

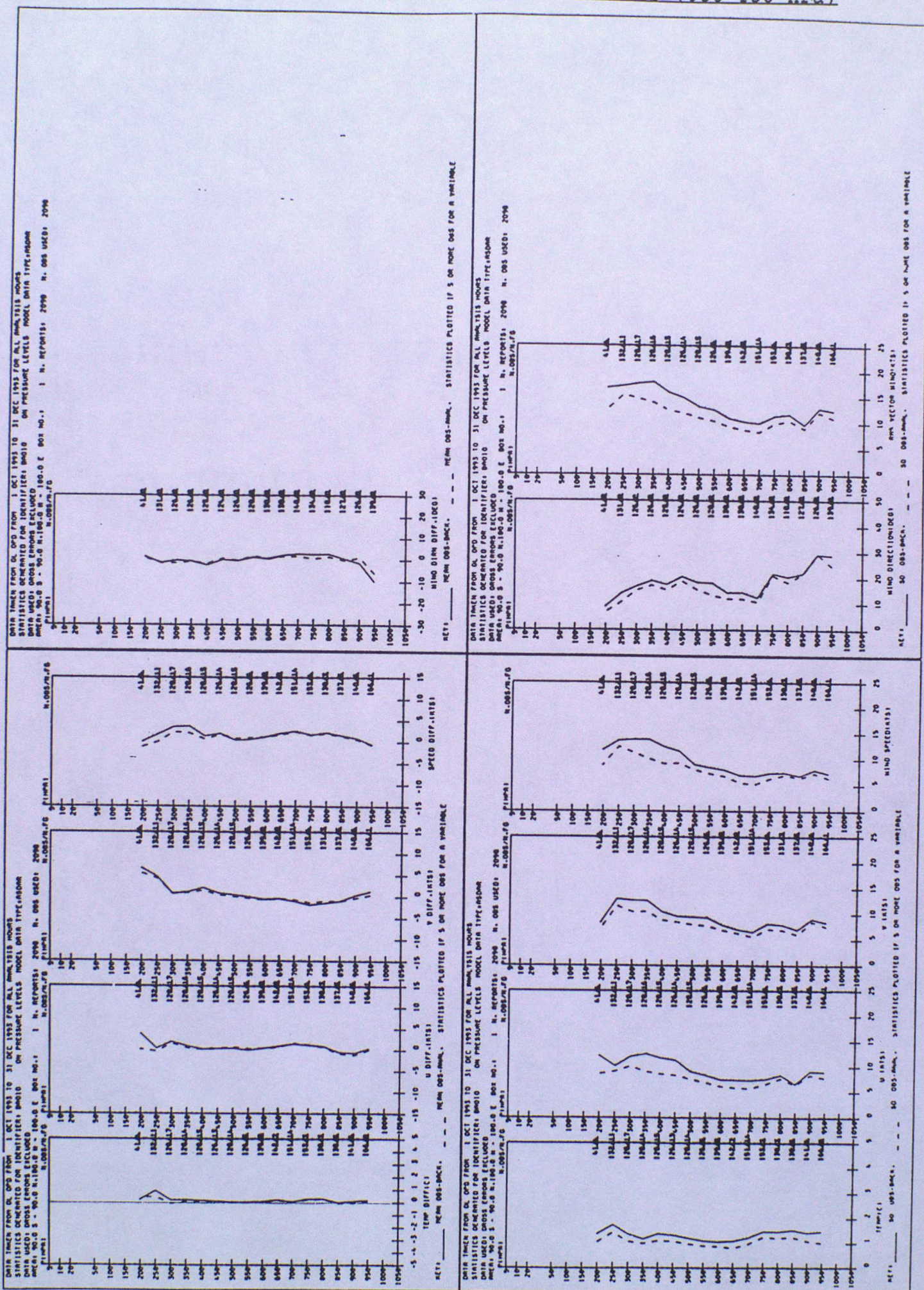


FIGURE 8 : CO00768Z - MODEL COMPARISON RESULTS (950-150 hPa)

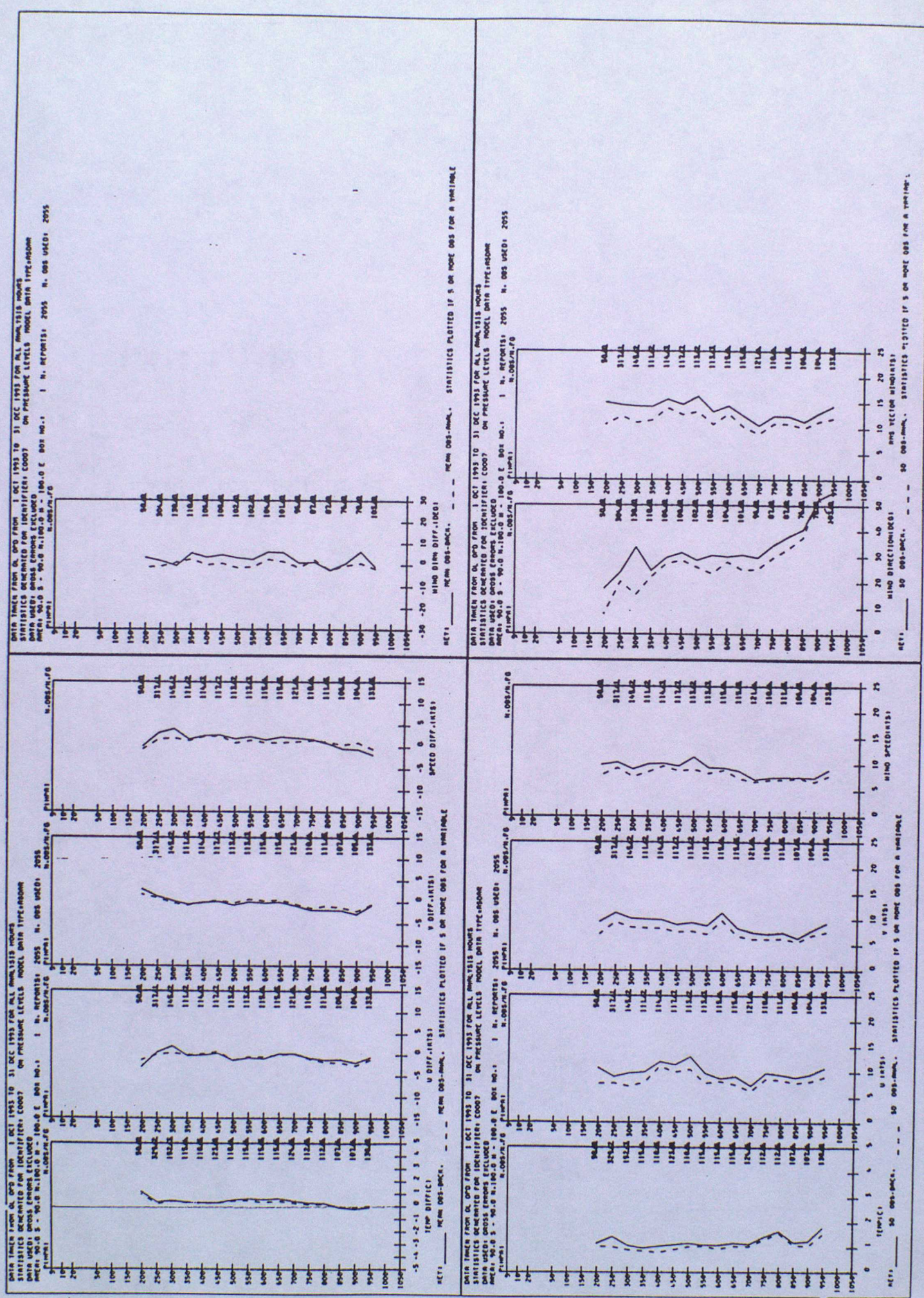


FIGURE 9 : KL012UMZ - MODEL COMPARISON RESULTS (950-150 hPa)

